

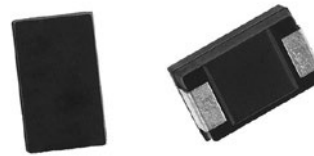
The Future COTS Bulk Metal® Foil Resistors are Already Here with Flexible Terminations System and Load-Life Stability of 0.005% (50 ppm)

FEATURES AND BENEFITS

- Temperature coefficient of resistance (TCR):
±0.2 ppm/°C typical (-55°C to +125°C, +25°C ref.)
- Tolerance: to ±0.01%
- Power coefficient of resistance “ΔR due to self heating:”
5 ppm at rated power
- Electrostatic discharge (ESD) at least to 25 kV
- Load-life stability: ±0.005% (70°C, 2000 h)
- Resistance range: 5 Ω to 80 kΩ (for higher and lower values, please contact us)
- Bulk Metal Foil resistors are not restricted to standard values; we can supply specific “as required” values at no extra cost or delivery (e.g., 1K01234 vs. 1 k)
- Power rating: to 600 mW at +70°C
- Thermal stabilization time: <1 s (within 10 ppm of steady state value)
- Non inductive, non capacitive design
- Current noise: 0.010 μVRMS/V of applied voltage (<-40 dB)
- Voltage coefficient: <0.1 ppm/V
- Low harmonic distortion, linear behavior
- Non hot spot design
- Inductive: <0.08 μH
- Terminal finishes available: lead (Pb)-free, tin/lead alloy, or silver

INTRODUCTION

When mounted on a board that is bent or flexed either during the manufacturing process or in the field, resistors can develop cracks that affect their electrical performances. The Flex Series is a surface-mount, multi-featured precision resistor that incorporates a unique flexible terminations system. Integrated with the latest



Flexible terminations assure minimal stress transference from the PCB due to a difference in thermal coefficient of expansions (TCE).

generation of Bulk Metal® Foil technology, Z Foil, the Flex Series' flexible terminations system is designed to establish pliability while maintaining terminal strength, solderability, stability, and electrical specifications.

The flexible terminations absorb board stresses, thereby preventing external stresses from reaching the resistance element.

Why choose the Flex Series

- Provides superior flex performance compared to standard terminations systems
- Flexible terminations isolate resistor body from PCB stresses
- Superior flex performance up to several mm

Stress checklist:

1. Where is the resistor going to be placed? Around big or heavy components? Solution: Flex Series.
2. Are you intending to place the resistor close to the PCB edges or corners? (Stress can occur due to bending or CTE difference.) Solution: Flex Series.
3. Will the PCB be exposed to high levels of boards flexure during assembly or mounting? Solution: Flex Series.

Table 1 – Tolerance and TCR vs. Resistance Value (-55°C to +125°C, +25°C Ref.)

Value (Ω)	Standard Tolerance ⁽¹⁾ (%)	Typical TCR and Max. Spread ⁽¹⁾ (ppm/°C)
50 Ω to 80 kΩ	±0.01%	±0.2 ±1.8
20 Ω to <50 Ω	±0.02%	±0.2 ±2.8
10 Ω to <20 Ω	±0.05%	±0.2 ±4.8
5 Ω to <10 Ω	±0.1%	±0.2 ±6.8

Note
⁽¹⁾ For values <5 Ω and tighter performance, contact us.

Note

* This datasheet provides information about parts that are RoHS-compliant and/or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS compliant. Please see the information/tables in this datasheet for details.

Figure 1 – Power Derating Curve

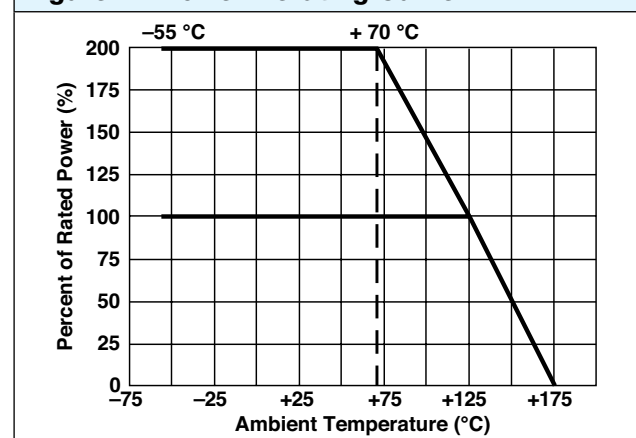
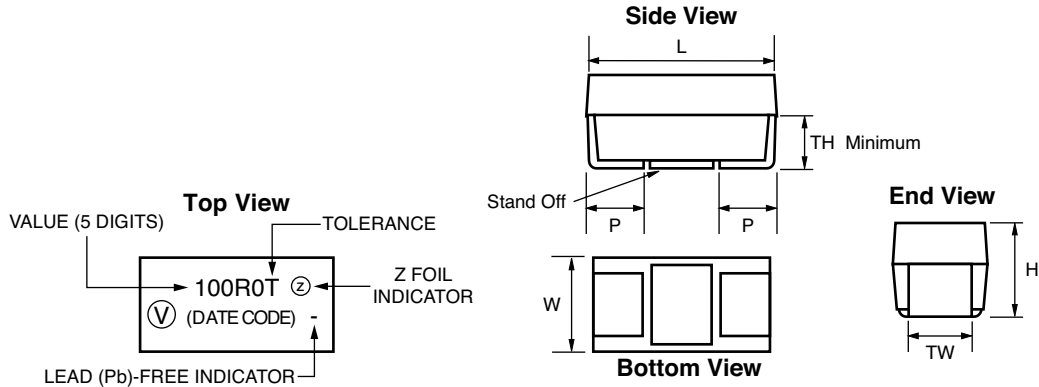


Table 2—Specifications				
Parameters	Specifications			
	Flex-1		Flex-2	
Resistance Range	5 Ω to 33 kΩ		5 Ω to 80 kΩ	
Rated Power	5 Ω to 10 kΩ 0.250 W at 70°C 0.125 W at 125°C	10 kΩ to 33 kΩ 0.160 W at 70°C 0.08 W at 125°C	5 Ω to 30 kΩ 0.6 W at 70°C 0.3 W at 125°C	30 kΩ to 80 kΩ 0.4 W at 70°C 0.2 W at 125°C
Weight	0.1143 g		0.244 g	
Packaging	Bulk (loose), waffle pack or tape and reel, per EIA-481-1			

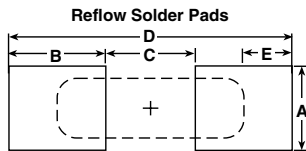
Table 3—Performances				
Test	Conditions		Maximum Limit ⁽¹⁾	
	Flex-1	Flex-2		
Max. Working Voltage	73 V	180 V	—	
Max. Operating Temperature	+175°C (see Figure 1)		—	
Working Temperature Range	-55°C to +125°C (MIL range)		—	
Thermal Shock	-65°C to +150°C; 30 min; 5 cycles		R > 100 Ω: ±0.02% (200 ppm) R ≤ 100 Ω: ±0.03% (300 ppm)	
Short Time Overload	6.25 x rated power; 5 s		±0.01% (100 ppm)	
Low Temperature Operation	-65°C, 24 h (no load); 45 min at rated power		±0.01% (100 ppm)	
Dielectric Withstanding Voltage	Atmospheric pressure; AC 200 V; 1 min		±0.01% (100 ppm)	
Insulation Resistance	DC 100 V; 1 min		over 10 000 MΩ	
Resistance to Soldeing Heat	260°C for 10 s		±0.03% (300 ppm)	
Moisture Resistance	+65°C to -10°C; 90% to 98% RH; rated power; 240 h		±0.03% (300 ppm)	
Shock	100 G; Sawtooth		±0.01% (100 ppm)	
Vibration, High Frequency	10~2000~10 Hz; 20 G; X, Y, Z each 2.5 h		±0.01% (100 ppm)	
Load Life Stability (2000 h)	0.04 W at +70°C 0.25 W at +70°C 0.125 W at +125°C	0.1 W at +70°C 0.6 W at +70°C 0.3 W at +125°C	Flex 1 0.005%, typical 0.02%, typical 0.05%, max	Flex 2 0.005%, typical 0.015%, typical 0.05%, max
High Temperature Exposure	175°C; no load 2000 h		±0.1% (1000 ppm)	
Note				
⁽¹⁾ As shown +0.01 Ω to allow for measurement errors at low values.				

Table 4—Dimensions in Inches (Millimeters)



Model	L	W	H	P	TW	TH Minimum
Flex-1	0.236 ±0.012 (5.99 ±0.30)	0.126 ±0.012 (3.20 ±0.30)	0.098 ±0.012 (2.49 ±0.30)	0.051 ±0.012 (1.30 ±0.30)	0.087 ±0.004 (2.21 ±0.10)	0.039 (0.99)
Flex-2	0.287 ±0.012 (7.29 ±0.30)	0.170 ±0.012 (4.32 ±0.30)	0.110 ±0.012 (2.79 ±0.30)	0.051 ±0.012 (1.30 ±0.30)	0.095 ±0.004 (2.41 ±0.10)	0.039 (0.99)

Table 5—Recommended Mounting Pad Geometries in Inches (Millimeters)



Model	Method	A Min	B Ref	C Ref	D ± 0.04 (± 1.02)	E Ref
Flex-1	Reflow	0.110 (2.79)	0.106 (2.69)	0.124 (3.15)	0.337 (8.55)	0.050 (1.27)
Flex-2		0.118 (3.00)		0.175 (4.45)		

Figure 2—Thermal Expansion

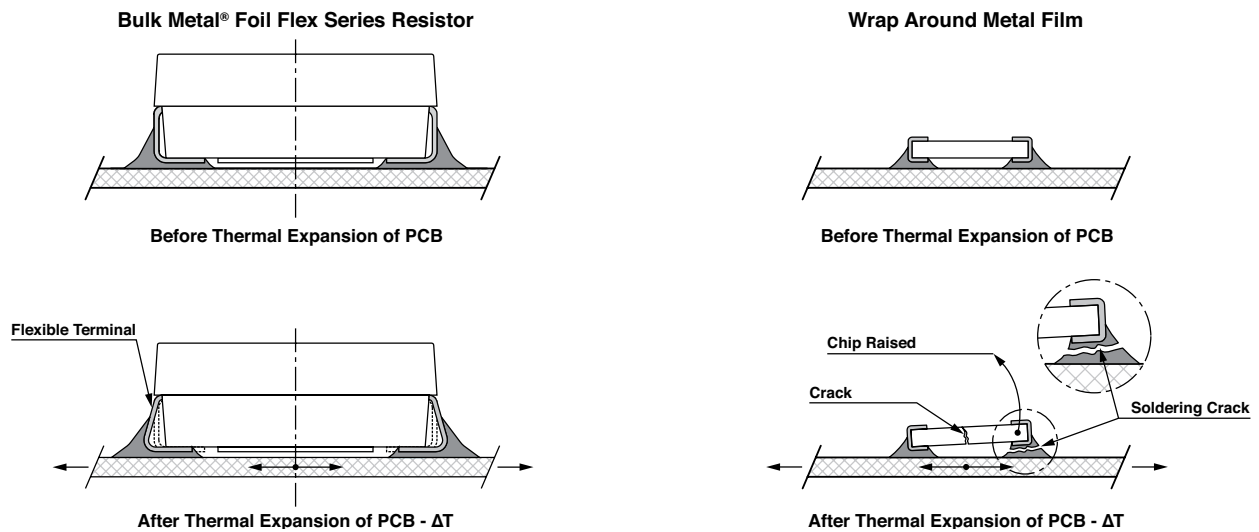
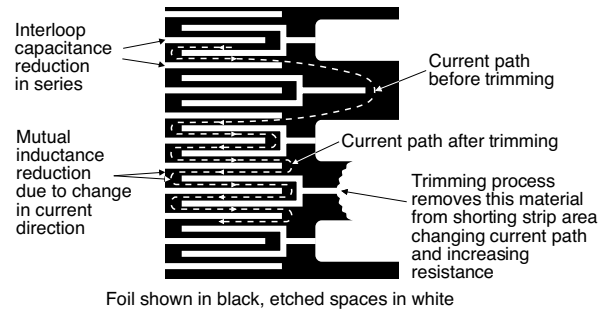


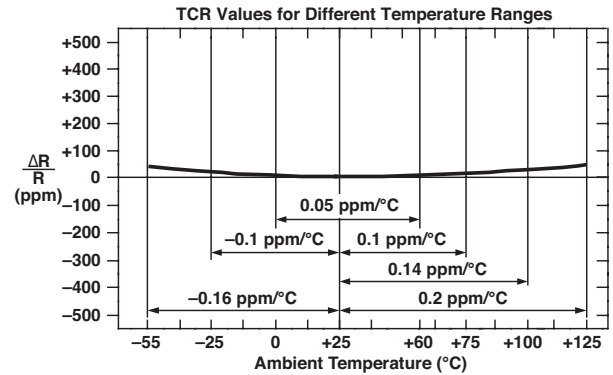
Figure 3 – Trimming to Values
(conceptual illustration)



Note

To acquire a precision resistance value, the Bulk Metal® Foil chip is trimmed by selectively removing built-in “shorting bars.” To increase the resistance in known increments, marked areas are cut, producing progressively smaller increases in resistance. This method reduces the effect of “hot spots” and improves the long-term stability of Bulk Metal Foil resistors.

Figure 6 – Typical TCR Curve Z Foil

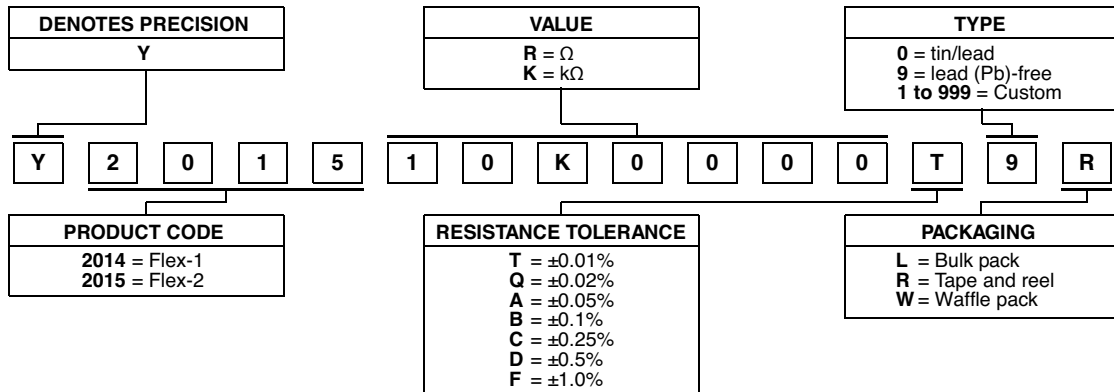


Notes

- For more details, see Table 1.
- The TCR values for <math><80 \Omega</math> are influenced by the termination composition and the result is deviation from this curve.

Figure 5 – Part Number Information

GLOBAL PART NUMBER: Y201510K0000T9R



FOR EXAMPLE: ABOVE GLOBAL ORDER Y2015 10K0000 T 9 R:

TYPE: Flex-2
VALUE: 10.0 kΩ
ABSOLUTE TOLERANCE: ±0.01%
TERMINATION: Lead (Pb)-free
PACKAGING: Tape and reel

PART DESCRIPTION: Flex-2 10K000 TCR0.2 T S T (will continue to be used)

Flex-2	10K000	TCR0.2	T	S	T
MODEL	OHMIC VALUE	TCR CHARACTERISTIC	RESISTANCE TOLERANCE	TERMINATION	PACKAGING
Flex-1 Flex-2	10.0 kΩ		T = ±0.01% Q = ±0.02% A = ±0.05% B = ±0.1% C = ±0.25% D = ±0.5% F = ±1.0%	S = Lead (Pb)-free B = Tin/Lead	B = Bulk pack T = Tape and reel W = Waffle pack



Disclaimer

ALL PRODUCTS, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Vishay Precision Group, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "VPG"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

The product specifications do not expand or otherwise modify VPG's terms and conditions of purchase, including but not limited to, the warranty expressed therein.

VPG makes no warranty, representation or guarantee other than as set forth in the terms and conditions of purchase. **To the maximum extent permitted by applicable law, VPG disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.**

Information provided in datasheets and/or specifications may vary from actual results in different applications and performance may vary over time. Statements regarding the suitability of products for certain types of applications are based on VPG's knowledge of typical requirements that are often placed on VPG products. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. You should ensure you have the current version of the relevant information by contacting VPG prior to performing installation or use of the product, such as on our website at vpgsensors.com.

No license, express, implied, or otherwise, to any intellectual property rights is granted by this document, or by any conduct of VPG.

The products shown herein are not designed for use in life-saving or life-sustaining applications unless otherwise expressly indicated. Customers using or selling VPG products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify VPG for any damages arising or resulting from such use or sale. Please contact authorized VPG personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.

Copyright Vishay Precision Group, Inc., 2014. All rights reserved.